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Bell Telephone MAGAZINE

Looking Ahead in the Bell System • MARK R. SULLIVAN

Welcoming Bell System Veterans Back to Work • LAWRENCE L. ARMANTROUT

The Blackboard Comes to Life • JOHN M. SHAW

Outwitting a River on a Rampage • RALPH E. MOONEY

American Telephone & Telegraph Company · New York

Bell Telephone Magazine

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Looking Ahead in the Bell System, *Mark R. Sullivan,* 5

Welcoming Bell System Veterans Back to Work,
Lawrence L. Armantrout, 20

The Blackboard Comes to Life, *John M. Shaw,* 25

Outwitting a River on a Rampage, *Ralph E. Mooney,* 41

"The ideal and aim of the American Telephone and Telegraph Company and its Associated Companies is a telephone service for the nation, free, so far as humanly possible, from imperfections, errors, or delays, and enabling anyone anywhere to pick up a telephone and talk to anyone else anywhere else, clearly, quickly and at a reasonable cost."

A Medium of Suggestion & a Record of Progress

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WALTER S. GIFFORD, *President;* ROBERT H. STRAHAN, *Secretary;* DONALD R. BELCHER, *Treasurer*

Who's Who & What's What

in This Issue

LOOKING AHEAD—foresight—is a prime requisite of the telephone industry even in normal times, and a characteristic of the

MARK R. SULLIVAN

industry's leaders. It assumes redoubled importance now, in view of the problems and uncertainties which appear to loom large in the years immediately after victory. Into this period MARK R. SULLIVAN takes a long look; and what he sees ahead augurs well for increased and improved service to the public while presenting to the Bell System opportunities for great accomplishment. Joining the Pacific Telephone and Telegraph Company as a traffic clerk in 1912, Mr. Sullivan had become by 1928 general traffic manager of the company's Northern California-Nevada area. Six years later he was made vice president and general manager of that area, in 1938 his duties became company-wide when he was made chief of staff of the operating vice president's organization, and the following year he was elected vice president in charge of operations. In 1941 he left the Pacific Coast to become a vice president of the A. T. & T. Company, where he is head of the Department of Operation and Engineering. His previous contributions to this MAGAZINE include "The Organization of Large-scale Engineering Work," "The Bell System's Post-war Construction Program," and "The Impact of War on Long Distance Service."

UNCERTAINTIES there may be as to what peace may bring; but there is no doubt about the cordial welcome which awaits Bell System employees returning from the

LAWRENCE L. ARMANTROUT

war, the thought and care which have gone into the plans for re-establishing these 60,000 men and women happily and pro-

ductively in the organization, and the need for their contributions to the continuing growth of the business. LAWRENCE L. ARMANTROUT, who makes clear these matters in later pages, joined the A. T. & T. Company's Personnel Relations Department in 1943, coming to it from the Michigan Bell Telephone Company. In that company, he entered the Traffic Department in 1925, and held various assignments involving manual, dial, and toll operation until, in 1937, he was transferred to the company's Personnel Department. Since going to New York two years ago, he has been principally engaged on personnel problems to which the war has given special emphasis.

PRODUCTION of motion pictures is no new enterprise in the Bell System, but their direction toward specific training problems in various departments is receiving added impetus as they prove their value in that field and as the training job necessary for post-war expansion grows bigger on the horizon. JOHN M. SHAW, who directs the A. T. & T. Company's motion-picture program as assistant vice president in the

JOHN M. SHAW

Information Department, first joined that department in 1930 after some years of experience in other public services and in the Army in the last war. Since that time he has been general information manager of the Chesapeake and Potomac Telephone Companies and an assistant vice president in the Public Relations Department of the New York Telephone Company—relinquishing the latter post last year to rejoin the A. T. & T. Company.

AS A long-time resident of St. Louis, RALPH E. MOONEY has an acquaintance with the Father of Waters which gives him some knowledge of what is likely to happen when

RALPH E. MOONEY

a river goes on a rampage—a useful background for the preparation of his article from information supplied by the Bell System companies in the area affected by this year's Ohio River flood. After some years of newspaper and trade journal experience, and service in World War I as a Captain of Infantry, he joined the Southwestern Bell Telephone Company in 1922. In 1924 he became editor of the *Southwestern Telephone News,* moved over to the advertising staff in 1938, and late last year transferred to the Information Department of the A. T. & T. Company, where he has recently been appointed Historical Librarian. He is the author of two novels and has contributed to various periodicals.

BY MEANS OF the buttons of the key set at her right hand, comparable in purpose to a telephone dial, this outward toll operator sets in motion a sequence of connections which will complete a call directly to a subscriber in a distant city—as discussed in the article beginning on the opposite page

With Peace Will Come a Constructive Program Including the Resumption of War-held Projects and the Development, Extension, and Improvement of Many Services

Looking Ahead in the Bell System

Mark R. Sullivan

NOW THAT V–E Day is behind us and a gradual relaxation of controls over materials and manpower is in prospect, questions are raised regarding Bell System plans for expansion. Forecasts, always subject to the uncertainties of the future, are more uncertain today than ever because of the many unknown factors ahead. Any estimate of the future, therefore, must be considered with full realization of the imponderables inherent in the present situation.

There is one issue concerning which there can be no uncertainty whatsoever. The shooting may be over in Europe, but the war will not be over until the last gun is fired in the Pacific. Until that happy day arrives, the primary duty of every person is to back up the armed forces 100 percent. To telephone workers, the obligation to serve has special significance; for they are entrusted with the responsibility of furnishing the nation with its telephone service—and telephone service is a war essential of the first magnitude. The coördination of military activities, war production, transportation, and every activity of the country depends upon it. The more than 30,000 million calls handled annually speed up all of the social, commercial, and industrial activities of the nation, and thus add immeasurably to its ability to wage war. Telephone men and women are in the fortunate position of being able—short of actually serving in the armed services—to help speed victory by doing their best, day in and day out, on their regular jobs.

Most questions relating to future plans have to do with the kind of projects to be undertaken and the speed with which they are expected to get under way. The kind of projects ahead can be stated with reasonable assurance. The speed with

which they will be undertaken cannot, however, be accurately foreseen. The flow of available men, materials, and money and the level of business conditions will control the speed with which the job is done.

THE LINEMAN at the left is making a rolled sleeve joint. There will be need for many more circuits in the post-war period

A bird's-eye view of the outstanding projects ahead is as follows:

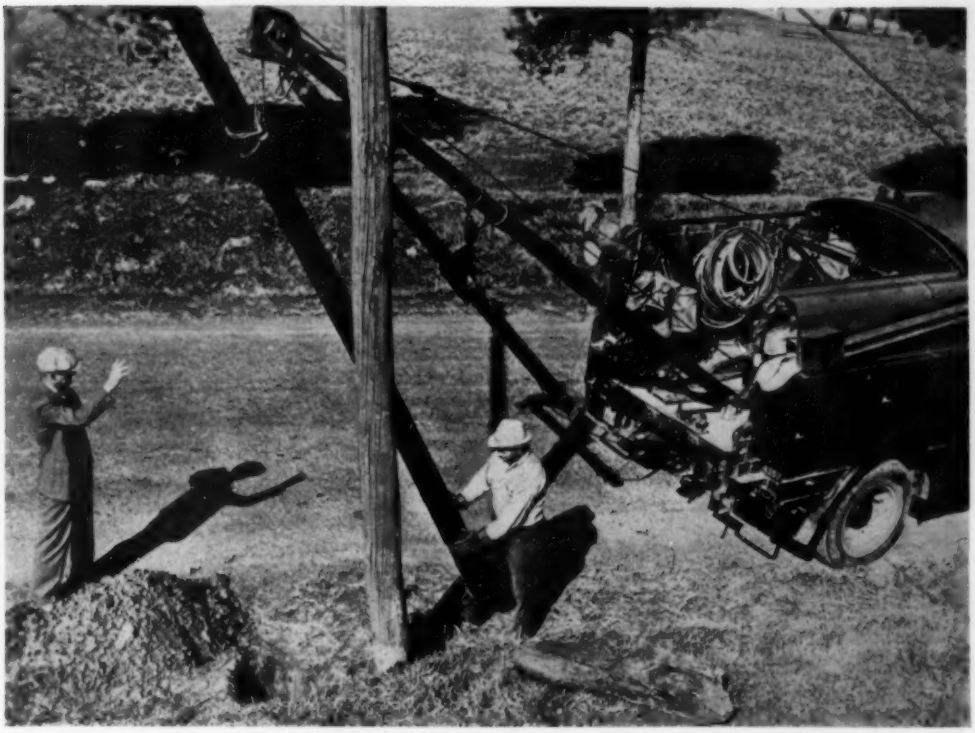
1. Catching up with requests for services now held in abeyance because of lack of facilities.
2. Catching up with plant shortages to provide for the volume of business presently being handled.
3. Replacements of temporary expedients adopted only for the war period.
4. Providing improved equipment on customers' premises.
5. Strengthening the long distance network, including provision for television and the use of radio facilities.
6. Extension and improvement of rural telephone service.
7. Replacement of manual equipment by dial equipment for local service.
8. Provision of equipment for operator dialing on toll circuits.
9. Provision of equipment for

subscriber dialing of toll calls where applicable.

10. Extension of service in such fields as service to motor vehicles, overseas telephone service, etc.
11. Provision for growth.

Some details on each of these projects are outlined in the following paragraphs.

Bell System companies are holding about two million applications for main telephone service for lack of facilities, and so far this year (first half of 1945) the number has been increasing at the rate of about 75,000 per month. In addition, there is a backlog of other requests for service including particularly 400,000 requests for residence extension tele-



A ROTTED POLE is being replaced by one of creosoted pine. Where safety is involved, maintenance has not been neglected during the war

Catching Up With Requests for Service

THE FIRST AIM will be to provide service, without delay, for all who wish it. At the present time the phones. To be sure, all of this backlog will not remain firm: many applicants will undoubtedly have moved away or for other reasons will not wish the service when we are ready to install it. What this "melt"—as

DESK-STAND telephones, now in use in large numbers, will gradually be replaced by improved instruments such as the combined set shown below

we call it in the industry—may be is entirely a matter of conjecture, but it could well be substantial. On the other hand, there is probably a large demand for services not expressed in our backlog because many people, knowing of the difficulties of getting service at this time, have deferred placing their applications until a more favorable time. Whether the firm backlog turns out to be two million or something higher or lower is speculative, but all things considered, it seems clear that taking care of the backlog will be a project of considerable magnitude.

Clearing Up Plant Shortages

DURING WAR-TIME it has been found advisable to load the plant beyond its normal capacity in order to give the maximum amount of service. This overloading will need to be corrected. Additional central office equipment, particularly dial, will be necessary to restore pre-war speed of service on local exchange calls and to absorb temporary peaks in traffic. Many additional toll circuits will also be required. An increase of approximately one third in the present toll circuit mileage is estimated to be needed to restore pre-war speed of toll service, and we plan not only to reëstablish but to improve upon that speed. Exchange cable plant will be required to make individual lines available to those who wish them where only party line service can now be provided.

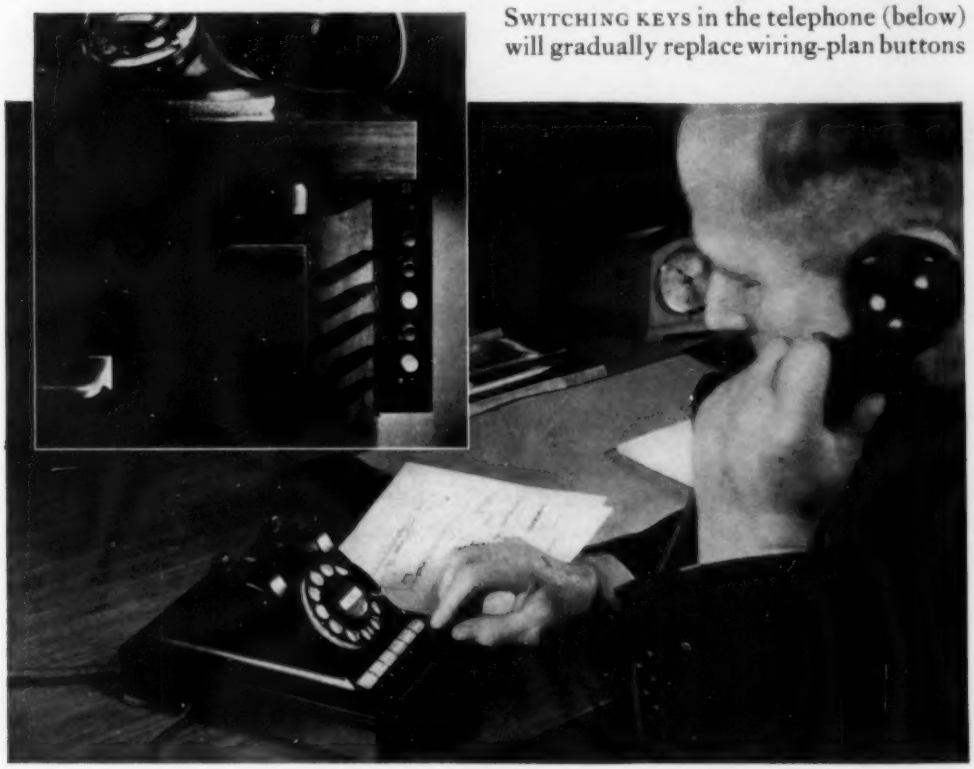
Replacing Temporary Expedients

SOME OF the expedients adopted during wartime to give the most service with the least manufacture of new equipment and construction of new plant are not satisfactory for continued operation. One item of this

nature is represented by 800,000 telephone sets of the pre-war types, which normally would have been junked but which had been saved for the war emergency and put back into service. In some cases, needed extensions of local exchange cable have been temporarily avoided by running pairs of open wire. It will also be necessary to catch up on certain maintenance work which has necessarily been deferred during the war period, and which will involve capital expenditures as well as current expense.

Improving Equipment on Customers' Premises

BEFORE THE WAR, the telephone companies were proceeding with the program of improving the type of equipment on subscribers' premises. Desk-stand telephones were coming out of service at the rate of nearly a million a year. This program will be resumed: there are still about two and one-half million desk stands in service, in addition to those referred to in the foregoing paragraph as being put back because of war shortages. Other improvements in customers' equipment for which, undoubtedly, there will be a demand in the future are dial PBXs in place of the manual PBXs, and key sets in place of the older types of wiring plans with separate keys. New forms of intercommunicating equipment and improved types of colored hand sets will be available after the war. Also, it will be desirable to re-

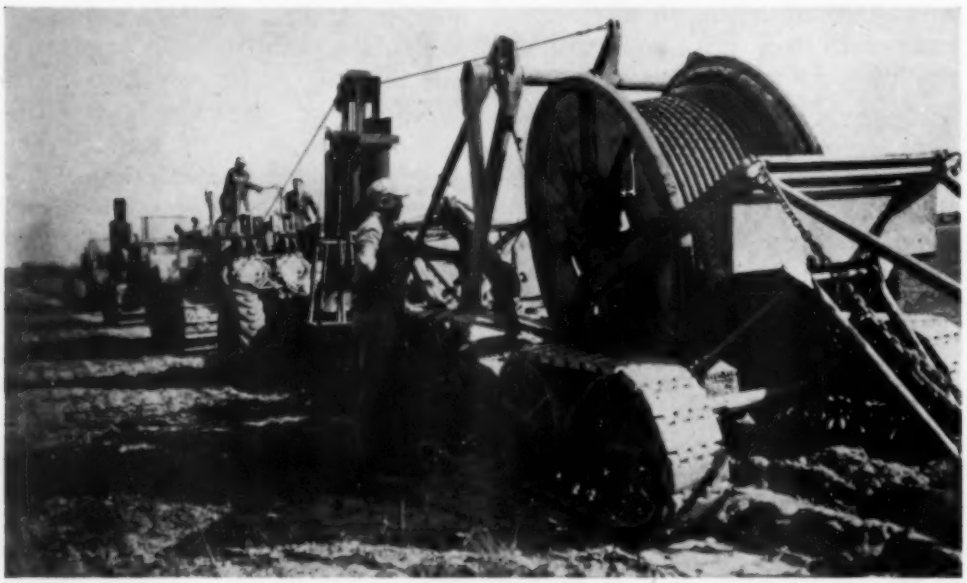


SWITCHING KEYS in the telephone (below) will gradually replace wiring-plan buttons

place some of the older types of dials, which are noisy, and to modernize a large number of public telephones.

Strengthening the Long Distance Network

OVER THE YEARS, the Bell System has tremendously improved its long distance facilities by the gradual installation of a large country-wide interconnected network of toll cables. Much of this cable network—about 70 percent—is underground, and even the 30 percent which is on poles is much less subject to damage by storms and other hazards than open wire circuits on pole lines. There are now about 25,000 route miles of long distance cable in service. Plans have been made for the appreciable strengthening of this cable network by the installation, over the next several years, of about 10,000 additional route miles. The additional cable includes a very important new transcontinental route supplementing the existing transcontinental open wire and cable routes. The new transcontinental cable will cross the southern part of the country, passing through Atlanta, Dallas, and El Paso and terminating at Los Angeles. Another important cable route will be from Chicago and St. Louis south to New Orleans, intersecting the southern transcontinental route at Jackson, Mississippi.



COAXIAL CABLE will have an important role in the expansion of the Bell System's long distance cable network. Here a 1,500-foot reel of cable containing six coaxials is being loaded onto the trailer of the plow train which deposits it, 30 to 36 inches deep, directly in the ground

In these extensions of the long distance network the important backbone routes to be built will be of the coaxial cable type. The coaxial transmission system is so called because it comprises a cable with coaxially arranged conductors (a central wire insulated by discs from a concentric outer conductor). With the addition of terminal equipment and broad band repeaters, it is capable of transmitting frequencies up to several megacycles. In the expected future art, the wide band will provide for transmitting several hundred telephone conversations and one two-way television channel simultaneously on each pair of coaxial units.

The coaxial cable on the main routes will include six or eight coaxial units and in some sections a number of pairs of wires in addition, according to the estimated need for circuits. Thus the plans already made are sufficient to provide the nucleus of a nation-wide television transmission network.

Another type of facility which may also prove important as a means of strengthening the long distance network is the radio relay system. Plans have been made and approvals obtained for the installation, which will go forward as rapidly as possible, of an experimental system of this type between New York and Boston with seven intermediate repeater stations. The radio relay systems will apply in the field of radio an established principle of long distance telephone lines: namely, the insertion of amplification in the cir-

AFTER THE WAR is over, the Bell System plans to resume its active program of extending rural telephone service, with the expectation of rapidly increasing the number of farm telephones

cuits at frequent intervals along their length. The very high frequencies to be used in this system require a line-of-sight path for their transmission which will require an average repeater spacing of about 30 miles. The resulting circuits are expected to be suitable for telephone and television transmission. The Bell System is interested in the best type of transmission, whether it be by wire or by radio, and, depending upon the results of the New York-Boston experiment, radio circuits for telephone and television may find widespread application in the Bell System network.

Resumption of Program for Extending Rural Service

BEFORE THE WAR, the Bell System was proceeding very rapidly with the extension of rural service. From 1935 to 1945 the number of rural and service-line telephones in the Bell System rose from 600,000 to a million. Over 80 percent of all farms in Bell System territory are now on existing telephone lines or near enough to be connected without a construction charge.

Nevertheless, many farms do not now have telephone service, and after the war the Bell companies propose to resume their active program with the expectation of rapidly increasing the number of farm telephones. In this program several recently developed types of facilities will be featured. These new facilities include high-strength steel wire making possible long span construction, carrier systems which can be superimposed on either power or telephone lines, and ultra-high-frequency radio.

Replacement of Manual Switchboards by Dial Equipment

PRIOR TO THE WAR, the Bell System was making rapid progress in replacing manual switchboards by dial equipment for exchange service. At the outbreak of the war about two-thirds of all Bell telephones were dial operated. Dial service proved most fortunate during the war because with the manpower and womanpower shortage the present amount of service could not have been given without the dial equipment.

It has been necessary to suspend this replacement program during the war, no new projects of this type—with negligible exceptions—having been initiated since 1941. After the war the Bell companies propose to go forward rapidly with the extension of dial service.

Development of Toll Line Dialing by Operators

BEFORE THE WAR, the companies had made a start in the application of dial equipment on toll and long distance circuits by which the toll operator at the originating end can complete a call to the subscriber at a distant point without calling on the services of an inward or through operator. At the present time about five percent of the toll board calls are handled by this method. Experience with this type of operating, which has been very satisfactory, justifies planning on its further development, and it is expected that the companies will proceed rapidly to equip a high percentage of all toll circuits for operator toll line dialing. By this means,

an important further increase in the speed of service will be made.

Subscriber Dialing of Toll Calls

AT PRESENT there is a certain amount of subscriber dialing of short haul toll calls where arrangements could economically be made for the call to be counted in the registers used for recording local message-rate calls. In these cases the short haul calls are registered as two or three local calls.

This method will be supplemented after the war by the application of developments now under way which provide for automatically preparing a record of a toll call dialed by the subscriber without any help from the operator. Under this system the record automatically prepared will contain all the necessary information for billing, including the calling and called numbers and the length of conversation. It will, therefore, be free from the limitations of the present method, as individual billing of the toll calls is possible. It is expected that this system will have wide application in metropolitan centers.

AT THE OUTBREAK of war, about two-thirds of all Bell System telephones were dial operated, and the rapid extension of dial service is an important part of the post-war program. This photograph shows crossbar dial central office switching equipment.

Extension of Services—Motor Vehicles, Overseas, etc.

THE Federal Communications Commission has been requested to provide, in their allocation of radio wave lengths, for a general radio telephone service to motor vehicles on a common carrier basis. Work looking to the inauguration of such a service in a number of cities is actively under way and it is hoped shortly after the war to make a number of such installations. It is rather early to determine to what extent this will be desirable, but many industries have shown great interest and it is likely that an extensive service will be developed.

The plans under way contemplate not only service in cities, which has been given to a limited extent in the past, but also service on main highway routes. Such services are of interest to truck and bus companies and many others. Within the cities, the service is of interest to taxicab companies, express companies, ambulances, doctors, public utilities, delivery companies, and a broad range of other firms. Radio telephone service may also be given to moving trains.

Before the war, the Bell System gave direct overseas radio telephone service to 31 points, and by switching at these points provided service to more than 70 foreign countries. Plans have been made for a considerable expansion of this service after the war, including additional circuits to the points heretofore served and new circuits to many points not now served directly. With the growing community of interest between nations, the potential capacity for the development of overseas service appears to be large, and it may be that material extensions beyond the present plans will be required.

Also, however carefully we may review the future as we now see it, there are certain to be additional projects making use of inventions to come which will inevitably flow from the tremendous momentum of the research and development work of the Bell Telephone Laboratories.

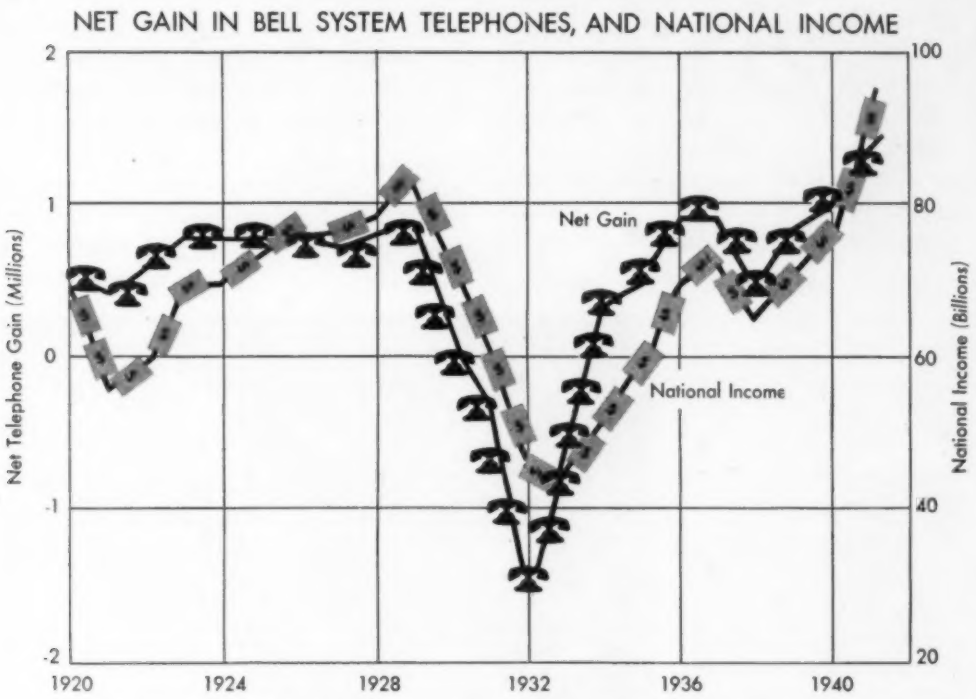
Growth

IN ADDITION to the projects necessary to catch up with suspended work and to improve and extend the scope of service, the System will need to provide for future growth.

An estimate of future growth at once involves a question of the general level of business activity, which is frequently measured in terms of national income. The chart on the opposite page is of interest as indicating the correlation of net telephone gain and national income.

Many predictions of post-war national income have been published, the figures most commonly quoted varying from 50 percent to 100 percent above the national income immediately before the war. Considerable emphasis is placed on a high national income being essential to servicing the national debt and in the interest of full employment. Surely every effort will be made to have business and government unite to bring about the desired production.

The net telephone growth of the Bell System for the 10-year period, 1935 to 1944, inclusive, averaged 840,000 per year (it would have been over 1,000,000 per year if fa-



Note: This chart is not posted beyond 1941 because national income in subsequent years has been distorted by war conditions.

cilities had been available in the war years to connect the applications now in the held-order file). On the assumption of a high national income, it would seem reasonable to look forward to a growth for a number of years averaging appreciably higher than in the past. It is not necessary at this time for the Bell System to make a specific forecast of telephone growth for any long period of time in the future, since the first requirement will be to take care of the backlog of unfilled orders; and after that is accomplished, plans to care for growth can be kept sufficiently flexible to conform with whatever requirements unfold. If the demand for net additional telephones should be as high as that experienced in the last ten years—about one million per year—expenditures for new construction of about $300,000,000 per year will be necessary for that purpose alone and any additional growth resulting from a further stepped-up national economy will add to even that huge amount.

Total Construction

IN TOTAL, it is clear that the postwar construction will probably be materially in excess of any prior experience, a billion dollar expenditure probably being necessary almost immediately after the war and another billion dollar expenditure probably being required within a very few years. Not all of the projects will be undertaken at the same time. At first the emphasis will be to catch

up on the essentials necessarily suspended during the war period. As this work progresses, emphasis will shift to plant for service improvements and for extensions of services. At the peak of the construction program, it is likely that the expenditures for construction will reach as high as $650,000,000 per year—which would be 50 percent higher than the highest year immediately preceding the war. The question, however, as to when this peak will be reached or how much will be done in any particular year or period can be answered at this time only in general terms, as stated in the foregoing, because it will depend upon how fast manpower, materials, and manufacturing facilities become available.

THIS recent picture of a small part of the Long Lines Department's overseas switchboard is timely as cessation of hostilities in Europe permits resumption of public service to an increasing number of points abroad. After the war, service will be extended to places not heretofore reached

Making Jobs

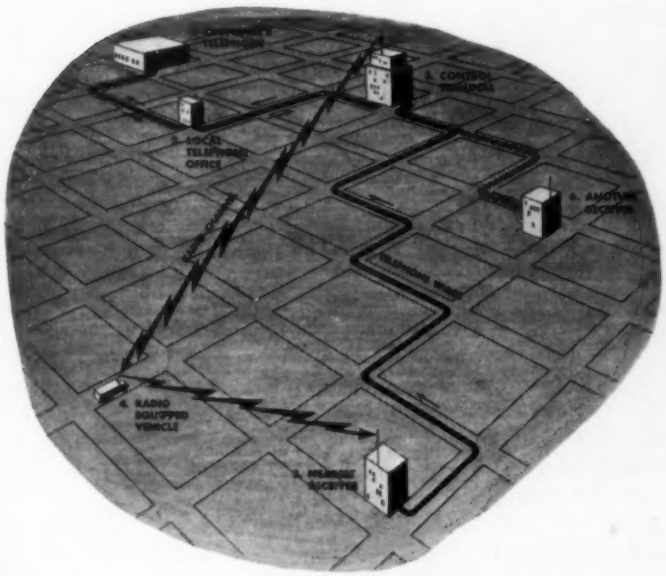
THIS PROGRAM will create many thousands of jobs. There is nothing in the proposed program that consists of "made work" for the sake of jobs alone. The projects considered are sound economically for the long-term pull and are required to render an essential service. At the same time, they will contribute to the over-all national welfare and prosperity.

These are projects wisely conceived and fully justified and in a strict business sense are capable of providing a return on the capital investment.

The projected program would mean within the Bell System jobs on a large scale. The full impact would be felt immediately in the factories, where the equipment is manufactured, and in the construction forces that build and install the plant. For these functions alone it is estimated that the program at its peak would provide jobs for 70,000 employees over and above the number now engaged in this work.

Then more jobs would be required in the forces that maintain and operate the plant after it is in service. And behind the jobs within the Bell System, there would be many involved outside the Bell System—in the mines and forests from which the raw materials come, in the foundries where the finished materials are forged, in the transportation systems over which the materials and equipments are shipped—in fact, the effects would be felt throughout the national industrial structure. It might be interesting to estimate the number of jobs required for all these purposes, but such an estimate would involve so many variables that it is perhaps more prudent merely to underscore, as may safely be done, that the projected program in total means jobs on a vast scale.

The program could be temporized in part by resorting to expedients which would defer capital expenditures and postpone jobs for the immediate period. For example, in adding to outside plant—the lines which connect the telephones at the customers' premises with the central office—it is frequently possible to add a few wires to an existing pole line



RADIO telephone service to motor vehicles, as illustrated in this sketch, would operate as follows: The customer (1) asks for "mobile service," his call going through the local telephone central office (2) to the control terminal (3), where a special operator signals the desired vehicle (4) by radio. When the driver answers, his voice travels by radio to the nearest receiver (5) and by telephone wire to the control terminal (3) and the local central office (2) to the customer's telephone (1)

which may be adequate to serve the immediate needs, rather than to put in a cable capable of meeting the needs for some years in the future as well as for the present. For the immediate period, less capital would be required and fewer jobs created, but maintenance expense in the long run would be higher and finally the cable ought to be provided anyway. In brief, some capital expenditures could be deferred but eventually the total expenditure would be greater than if the plant were engineered and installed correctly in the first place. The principle of this simple illustration applies to all forms of telephone plant, including outside plant, station apparatus, and central office equipment.

Getting Money

BUT WHY consider deferring construction by resorting to uneconomical expedients? Such a policy would not produce, but reduce, jobs at a time when the most vital need will be jobs—jobs for returning service men and women and jobs for those now in war work. After all:

We know how and where to get the basic raw materials, such as copper, steel, lumber, and all the other things required. If the money is available, we will be able to buy the materials—and go ahead with the jobs.

We have the know-how to convert raw materials into useful and profitable equipment and we are anxious to put that know-how to use—to make jobs.

Manpower will be available, and if we have the money we will be able to hire it—for good jobs.

The one big "if" in this picture is having the money to buy the things and employ the services necessary to apply the know-how which will create jobs. It may seem strange, considering the resources and the financial strength of the Bell System, to raise a question about getting the money to pay for materials and manpower for a program that is in the interest of all concerned. As a matter of hard brass tacks, however, it amounts to just that.

The Bell System's reputation of financial strength is properly deserved. Since 1920—mostly in the 1920's—the Bell System companies have raised additional capital in excess of $2,500,000,000 (excluding refunding). Since we did it before, we ought to be able to do it again. But the Bell System has no magic method of raising money. It must obtain additional capital in competition with everyone else who is in the market for it. The investor takes many things into account in appraising different investments, and it is his appraisal which determines whether we get his money and at what prices. A controlling factor in the investor's judgment is what return will be available to him. The investor, in analyzing the value of Bell System securities, considers the record of the past, the performance of the present, and the prospects of the future.

Therefore, it is vital to the System to sustain its credit position, which is dependent upon its earnings, now as well as in the future, so that it will have the financial strength required for the huge program of expansion which lies ahead. Concurrently an improved telephone service will be

rendered to the nation. These dual results will make a contribution in the national interest in keeping with the best Bell System tradition.

Looking ahead, the stage is set for expanding activities; and in the telephone industry the proper marshalling of men, money, and materials will speed up the realization of the much-to-be-desired objective:—more service to the nation, more jobs for its men and women.

READERS who recall "A Review of Army and Navy Communication Facilities," by Myron F. Dull, published in these pages in the Spring of 1944, may be interested to know that the work therein described has won high praise for the increased efficiency and economy achieved in military communications in this country.

In a letter to President Walter S. Gifford of the A. T. & T. Company about the contributions of the Bell System "Communications Committee" which made the surveys and offered recommendations, Major General Harry C. Ingles, Chief Signal Officer of the Army, said in part:

"The Communications Committee, which worked directly with communications personnel of the Army Communications Service, has been the biggest single factor, in my opinion, in the efficient organization of the Army's domestic communications facilities which are now operating on a highly efficient and satisfactory basis, notwithstanding the tremendous increase in traffic volumes. As a direct result of the Committee's work, a great improvement has been effected in the service rendered with large reductions in costs to the government and resultant savings in equipment and line facilities. This Committee has made possible very close coördination between the Army Communications Service and the various Bell System companies, which has been of material benefit in the solution of common problems."

The 60,000 Employees Now in the Service Will Find Both a Warm Welcome and an Integrated Program for Using Their Capabilities in an Expanding Public Service

Welcoming Bell System Veterans Back to Work

Lawrence L. Armantrout

"JOBS for all these employees will be ready for them when their present work is done. Their skill and energy are important assets of the System and will be needed in the big tasks which it faces in the future."

With these words President Walter S. Gifford of the A. T. & T. Company, in his Annual Report for 1944, reaffirmed the basis of the Bell System's program to welcome back more than 60,000 men and women serving in the Armed Forces and Merchant Marine.

The program is three-fold. Each phase is an essential part of the whole. The first is to plan the progress of System operations and the extension and improvement of its public service so that jobs will be ready. The second is to establish and administer a policy with respect to the wages of returning employees, and their credit for service under the Benefit and Pension Plan, which will be fair to each individual and equitable to all. The third is to prepare and carry out detailed procedures leading to the right job assignment for each person and the greatest possible opportunity for him to find genuine satisfaction in his work.

Let us look at each part of this program a little more closely:

Jobs Will Be Ready

AS MR. GIFFORD has said, the prime fact is that the Bell System will *need* the skill and energy of its returning service men and women in the big tasks which it faces. However, those tasks do not just happen. Rather, they spring from the conception that the job of the Bell System is to render an ever improving communication service, constantly wider and more useful in its scope. Therefore it has been and will continue to be essential for the organization to develop better

ways of doing the job, and to apply these improvements in projects which will be fruitful of more and better service on the one hand and greater work opportunity on the other.

Today, in consequence of such long-term enterprise, the System looks forward to a vast amount of useful work. The backed-up demand for telephone service must be met. Plant margins must be restored. Considerable war-built plant must be replaced by new and better facilities. Improved types of exchange and toll central office equipment will be introduced in large quantity. A big program is pending to extend and improve rural telephone service. The long distance cable network will be substantially enlarged. New types of radio facilities give promise of wide application. Overseas radio telephone service will be expanded. Plans for all of these and other undertakings are in progress today. All of them stand behind the assurance to Bell System veterans that jobs will be ready for them when their present work is done.

Wages and Benefit Credits

EARLY IN 1945, each Bell Company employee on leave of absence in the Armed Forces and Merchant Marine was informed that on his return to work within the period specified by the Government, he will receive a rate of pay which will be the same as if he had worked continuously with the Company on the job he held at the time he went on military leave. This means that his new rate of pay will include all increases he would have received had he stayed at work in that job. If a new assignment is necessary or desirable, he will receive the rate of pay appropriate to the new assignment. Each veteran will also receive full service credit under the Benefit and Pension Plan for the entire period of his absence on military leave.

In this policy, as in its entire program, the System expresses its desire to live up to and beyond the spirit of the Selective Training and Service Act and other legislation which covers the employment rights of the veteran.

Job Assignment and Training

NOW let us see how the System has planned the actual process of welcoming its service men and women back to work.

Each returning employee wants to feel that his Company is planning for *his* return, is thinking about *him* and the job *he* is going to hold. Likewise, employees on the job at home have a natural desire to give their returning fellow-workers the best possible welcome and to coöperate with them as they adjust themselves to a different way of life. The program of the Bell System Companies is therefore simple and clear-cut: It is to enable each veteran to find his right place on the team, and to set up uncomplicated but thorough procedures so that each part of the organization can translate the natural feeling of welcome into effective action. While the plans of individual telephone companies may differ in detail, all have the same fundamental pattern and look to the same objectives.

Most veterans, it is anticipated, will want to go back to their old jobs. A substantial number, however, will have matured beyond the scope of their former work. Others may wish

to change their occupations or the locations from which they entered military service. A few may be unable to resume their former work because of physical disability. In every case, the Company will try to make sure that the employee is assigned to a job which fits his total qualifications—one in which he can make his greatest contribution to the business and feel that he is doing so—and one which will facilitate his adjustment from military to civilian life.

This means that the wishes as well as the qualifications of returning men and women will be carefully considered. Capacities and skills which they have developed as a result of military training and experience will be recognized and used to the fullest extent practicable, both in the initial job assignment and in charting the employees' future career. The veteran who has a physical disability will be placed (and trained where necessary) on a job *which fits his particular qualifications,* not merely on a job he can do.

The Three Major Steps

THERE ARE three major steps in the procedure which has been set up to achieve these results. In the telephone companies, the first is to make a "planned tentative assignment" in advance of the time when the employee returns to work. This tentative assignment is based on supervision's knowledge of his qualifications at the time he went on military leave, plus careful study of all available information regarding his military training and experience. The amount of such information that is available of course varies with different individuals, but every effort is made to keep the employee's record as complete and up to date as possible. By definition, tentative assignments are subject to change, and many of them no doubt will be changed. Nevertheless, they focus attention on each individual, stimulate the thinking of supervisors, and help to prevent confusion when the veteran does return. Also, because the majority of tentative job assignments will no doubt become the actual assignments, taken all together they provide information that is invaluable in force planning both by location and by occupation.

The second step is, of course, the actual placement of the returning employee. To assist supervision in placing the right man or woman in the right job, there is generally in each Company an over-all Placement Committee composed of members of each department. These committees help to coördinate the actual work of assignment which is going on from day to day, as for example when a returning employee is assigned to work in a different department from the one he worked in before. They also keep track of results, with particular emphasis on the placement of employees who may be disabled, and give advice and assistance whenever required. Finally, they keep the whole procedure under study and recommend changes which experience shows are needed.

In many instances, the natural person for the returning veteran to get in touch with will be his old boss. The boss will welcome him, sit down and talk with him, and see that he meets all the old and new friends in the Company whom he wants to see. He'll be deeply interested, too, in learning what the veteran's ideas are and what he wants to do.

Next, the boss will usually call on an appropriate "placement representative" to confer with the returning employee and to discuss with him in detail the question of a specific job assignment. The placement representative may be a specialist who functions interdepartmentally, or he may be one of a group of selected supervisors in any department. He has at hand all the information developed in the preliminary plans for the veteran, and is closely familiar with job opportunities in the department or Company. Together, he and the veteran now review all the facts in order to arrive at a job assignment that will be agreeable to the employee and to the Company. During the interview a complete record of the employee's military service is secured and made a part of his permanent personnel record.

As an aid in finally making the proper assignment, the returning veteran will ordinarily have a medical examination. The placement representative arranges for this and keeps in touch with the medical examiner. From the employee's standpoint, as well as that of the Company, it is imperative that he should not be asked to perform work beyond his physical capacity. Objective data are available concerning the physical requirements of different jobs, and these are helpful in the study of what may be the best assignment for an employee who has some physical limitation. Decision not to reinstate an employee because he is not physically qualified for *any* job can be made only by a Company officer after complete interdepartmental review.

When the placement representative and the returning veteran have worked out what looks to be the right assignment, it is then recommended to appropriate management for approval. Responsibility for the decision, as for the employee's happiness and progress from the time he goes on the job, rests with the supervision under which he is to work. The function of the placement representative has been only to assist supervision, not to assume its responsibilities.

The time when the veteran is to start work will depend entirely on his own wishes. It may be the same day he first comes in. (Incidentally, this indicates the simplicity of the procedure at the time of his arrival. A prime reason for all the preliminary work that has been done is to make sure that the proper assignment can be made promptly.) Or he may prefer to start at some reasonable time in the future.

In the third phase of the veteran's return to Bell System work, his supervisor, as already indicated, has the key responsibility—and opportunity. Through his own ability, his understanding, his capacity for leadership, he can make a contribution of the utmost importance in assisting returned employees to find satisfaction and happiness in their work.

The person who returns from military service will in many instances come back a different man from the one he was when he left. He has been trained for a very different kind of job and has led a vastly different life. His activities, discipline, aims, and friendships have all been unlike those which filled his civilian life.

The situation to which he returns will at least in some degree seem

changed. This may be true with regard to his work environment, as well as to conditions at home, even though he is assigned to his former job. Conditions of living generally will have changed. During his absence he will have remembered things as they were, and he may have built up a rosy picture of the life he would come back to. Reality may fall short of these expectations.

It will be necessary for each person coming back to reconcile these differences. Most men and women will make the adjustment in time. Many will make it quickly. But it will be harder for some than for others, depending partly on temperament, age, and military experience, as well as on such factors as family, friends, and environment.

The supervisor can assist the employee to make this change successfully in a reasonable time. Re-orientation training to inform the veteran about what has happened while he was away, and re-emphasis on safety, quality performance, good public relations, and the like, will help him to feel at home again in the telephone work situation. Refresher training, tailored to his individual needs, will help him to put his old skills to work again—and his new ones too, so far as possible—so that he can make up for lost time.

It will be the responsibility of supervision to see that the employee obtains all the advantage which such training can afford. The supervisor will be alert, also, to the employee's progress on the job, and in any case where it appears that the job assignment is not working out as expected, he will take constructive action. In ways such as these, the supervisor will make his essential and continuing contribution toward the fulfillment of the Bell System's program for all its returning service men and women.

The System is proud of those men and women. It can find no more appropriate way to honor them than to plan and carry out effective procedures for welcoming them back to useful work that needs doing.

IF THE TRADITIONAL American way of life continues, the present level of living—both material and intellectual—should continue to improve within the limitations set by human frailties. In this American experiment the Bell System intends to provide a living and a good life for the people who are in it, and a constantly improving service to the rest of the public in their pursuit of happiness. The way in which we make a living is the day-by-day practice of democracy. It is the essence of the American experiment. To be an effective part of this greatest of all human enterprises is the part which the Bell System hopes to continue to play.

From "The Bell Telephone System," by Arthur W. Page, Vice President, A. T. & T. Co. Harper & Brothers, publishers, 1941.

Films Will Have an Increasingly Important Part in Training Bell System Men and Women in the Skills which They Must Acquire to Handle Their Jobs Effectively

The Blackboard Comes to Life

John M. Shaw

"WHERE DO FILMS BELONG in Bell System training, and how shall we go about making and using them?"

Many people have been asking this question of late, in many parts of the Bell System. They have been arriving at the answer by the very practical process of trial and error. Let us begin this discussion by telling a few stories about the use of films by telephone people.

PORTRAYING ELECTRICAL APPARATUS

A FEW YEARS AGO certain equipment was developed for use in central offices which was both new in principle and complex in operation. Plant forces in one of the larger cities found that the equipment could be understood by the men who had to install and maintain it only after a long and difficult course of training. Using an amateur 16 m/m motion picture camera, the plant training staff animated and photographed drawings of the new equipment in such a way as to make its electrical characteristics clearly apparent. The principle of its operation was described by pictures on the screen before the class to amplify the spoken words of the instructor. By the use of this home-made teaching device, the men were better trained than first seemed possible, and in half the time.

CLARIFYING A CLERICAL PROCESS

ONE OF the Bell System's revenue accounting centers worked out a new time-saving method of assembling cash stubs and applying payments to customers' accounts. Results indicated that extension of the new method throughout the System would offer an opportunity for some substantial conservation of money and manpower. The handling and processing of these stubs is a manual job, and is not easy to describe in words alone. The new method, to be fully understood and appreciated, had to be demonstrated. A slow-motion film of two experienced workers was made, from which every detail of the process could easily be seen and followed. This film was

sent to accounting people throughout the System, thereby assuring a correct understanding of the new method and making available an effective training aid. A number of companies have now adopted the new method and given testimony to the training value of this film.

TECHNICAL ACCURACY is a "must" in Bell System film-making

SHOWING HOW OTHER DEPARTMENTS WORK

THE COMMERCIAL PEOPLE who man the Bell System's business offices are properly known as "representatives" because they are called upon to interpret the operations of every other department in terms that the customer will understand. The need for giving large numbers of new people this background came at a time when the business offices were faced with their heaviest loads and when shortage of facilities made public understanding particularly difficult to secure. This presented a wartime challenge to test the ingenuity of the best instructor. Individual visits to other departments were out of the question. Using a new training technique that combines motion and still pictures, one company set out to describe, in a series of films, the operations of Plant, Traffic, and Accounting departments as they touch the customer. Most of the Bell System's ten thousand Commercial representatives have since received this training.

HOW TO CLIMB A POLE

THE CLIMBING of a pole is a skill that has to be constantly taught to succeeding generations of telephone linemen. There is a right way to climb a pole, and there is a wrong way: a safe way, and an unsafe way. The right way calls for a rhythmic coördination of arms and legs, and for dexterous manipulation of climbing irons and safety belt. These things can only be learned by practice. But unless the new lineman gets off to the right start under the watchful eye of a skilled instructor, he may become habituated to the wrong way. An ingenious Plant supervisor exposed thousands of feet of color film showing a highly-skilled climber going up and down a pole. He then had a sound track applied to the film, with a professional narrator describing each movement and the reason for it. The lineman-in-training may now see how an expert climbs a pole when he is at his best. He sees the right way again and again, from every angle and from every position on the pole. The consequences of doing it the wrong way are dramatically brought home to him by the enacting of a serious accident. More than fifty prints of this film have been used by Bell System companies.

DRAMATIZING EFFECTS OF CARELESS WORK

WITH THE unusual number of new operators occasioned by the war, the Traffic people observed a disturbing increase in errors on toll tickets. A sound slide film was made which showed in dramatic fashion the inconvenience and loss that result to

other departments and to telephone users by a slight error in noting the time of a call or the number of the called or calling party. The film was shown with good effect to toll operators in many Bell System companies.

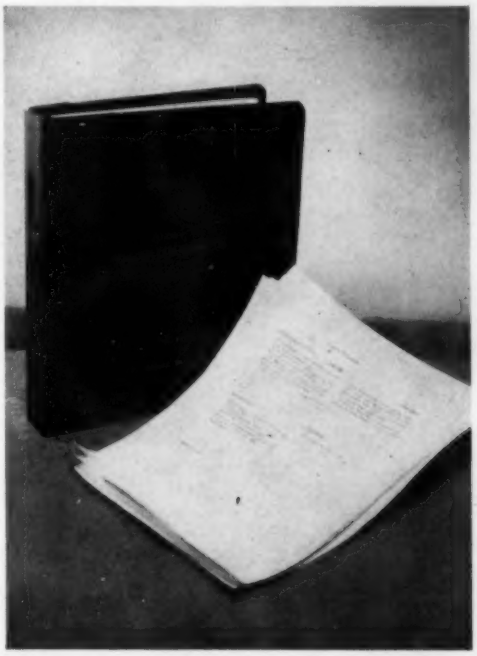
STIMULATING INTEREST IN PENSION PLAN

ONE OF THE COMPANIES dramatized its benefit and pension plan on a sound-slide film, and was thus assured of the undivided attention of all employes to this important matter for at least fifteen or twenty minutes. Several other companies have since adapted this film to their own purposes. When policy questions are involved, such films have the advantage of insuring uniformity of presentation combined with a dramatic forcefulness that is difficult to achieve just through writing or talking.

MAKING A HUMDRUM JOB INTERESTING

WESTERN ELECTRIC'S war-time job called for the packing of vastly more equipment, with fewer experienced packers to do it. New people, many of them women, had to be taught to drive nails. A highly skilled nailer was photographed in film. Step by step, every detail of nailing a packing case was pictured. World Series movies were spliced into the film to show that the swing of the skilled nailer has the same basic motion as the swing of the champion batter. In dramatic narration, it was made clear that winning a war means driving nails as well as pulling triggers. The film not only shows how nails should be driven, but makes the audience *want* to go out and drive nails. Now every nailer at the Kearny plant sees "Hit 'em on the Head" as part of his basic training.

It would be possible to fill twenty pages and more with similar examples of films produced by Bell System people to supplement specific training programs. At least as many more could be filled telling of films made outside the Bell System and applied to our use. A catalogue has recently been issued by the Motion Picture Division of A. T. & T. listing and describing these films.



NEARLY 200 films are listed in this new Bell System catalogue

Scope and Purpose of Training Films

THE USE of films in training programs, in the Bell System and elsewhere, has been handicapped somewhat by a misunderstanding of their scope and purpose. Advocates of visual training in the educational field have at times made promises that present equipment and skills could not fulfill. Films have sometimes been crudely made and inexpertly used. Training people, seeing the new device at its worst, have

TITLE FRAMES of some of the motion pictures and slide films produced by Bell System Companies

in such cases been discouraged against further experiment.

These are but the natural obstacles that every new technique encounters in the process of finding its place and proving its worth. To overcome them, it is well to view them in their proper perspective.

The Board of Education does not fire the teacher nor lower the educational requirements of its teaching staff because the school acquires a new and better blackboard. Neither should the training film be thought of as enabling a training job to be done with unskilled instructors. The film does not replace the instructor. It doesn't even replace the blackboard. It is nothing more than an ingenious tool which under certain conditions the instructor may use, very much as he uses the blackboard, to make his teaching more effective.

Instead of drawing a crude diagram or picture on the blackboard, the instructor flashes the diagram or picture on the screen, bringing to his aid specialized skills that he himself does not possess—the skills of draftsman, artist, photographer, actor. Instead of describing by word and gesture how an object moves, the instructor shows the object itself moving on the screen. Instead of attempting to describe the sound made by the object, the instructor brings the sound itself into the classroom and reproduces it *exactly* for the benefit of his students.

The skilled teacher uses the blackboard as he talks, thus reaching the mind of the pupil through the eye as well as the ear. In much the same way, the skilled teacher can use film to illustrate and amplify his instruction. The film thus tends to

become an integral part of the teaching process rather than an appendage to be used to give the instructor a breather if time permits.

Experience in the Bell System and elsewhere indicates that films have certain advantages which have already been partially realized but which we may expect will accrue in ever-increasing measure as the techniques themselves are improved and instructors become more skilled in their application.

Advantages of the Film Technique

THE BASIC ADVANTAGE of the use of pictures is the general one that the mind is reached through an additional sense—that of seeing. But certain specific benefits are also worthy of mention.

Things which lie beyond the horizon of normal vision, such as hidden parts of an intricate machine, can be brought out and clearly shown from any angle. They can be cut apart and shown in cross section. They can be shown in relation to other parts with every extraneous section of the machine rendered invisible.

Physical things that are very small can be enlarged a hundred or a thousand times and made clear to a large class simultaneously.

Operations too fast for the eye to follow can be slowed down and watched in detail.

A story can be told in carefully chosen language and, once the best arrangement of words and emphasis is determined upon, this high standard is maintained uniformly.

Discussion is stimulated.

Diagrams can be made to come alive to illustrate principles or operations.

Motions otherwise invisible, such as the flow of a current, can be portrayed, simplifying instruction of difficult subjects.

EACH of these films met a specific training need of one or more Bell System Companies

The entire class can see the object under discussion from exactly the same angle as the instructor sees it, whereas in actual demonstration the object is seen from many angles.

Prosaic situations can be made dramatic, professional actors of high skill being at the beck and call of every instructor at every session of the class to help him combat monotony.

A change of pace is afforded the instructor, his energy and time are conserved, and thus his full skill can be brought to bear on that part of the classroom work which can only be done by personalized instruction.

Supplementary training can be done in cases which may not seem to justify the full-time use of competent technical instructors.

Where visits to distant places to view field operations, or the functioning of other departments, are impractical, these distant scenes can be brought into the classroom.

Music and color can be used when these will contribute to either understanding or interest.

Attention is concentrated, and external distracting influences removed.

The student experiences emotionally the significance of the lesson that is taught.

Entertainment can be added to instruction, making films welcome at social gatherings where other forms of teaching may be out of place.

The impression that a good or bad job creates on customers or other employes who are unseen can be brought forcefully to the attention of the employe in training.

FILMS can help in the teaching of telephone jobs as basic as climbing a pole —

As a result of these general advantages, students learn more thoroughly and quickly; once learned, the message is retained longer.

Limitations of Film Techniques

THE ADVANTAGES of the film techniques will be more quickly achieved if we understand also their limitations. These are for the most part limitations of projection rather than of production, and they exist to greater degree to the extent that motion and sound are desired.

The room must be darkened, at least partly.

The projector must be placed some distance from the screen, as a result of which the instructor is usually at the front of the room and the projector at the back.

The projectors, particularly in the case of sound-motion, are somewhat complicated in their operation; and if they break down, as happens all too frequently, they are not easily put right again.

There is great variation in the projectors of different makes. Some have poor sound but good optical characteristics. Some have poor optical characteristics but good sound.

If motion is used, the film cannot be stopped once it is started moving through the projector, so that class discussion is not feasible as the film progresses.

If it is desired that a picture or diagram be held on the screen, then motion is impossible unless two projectors are used.

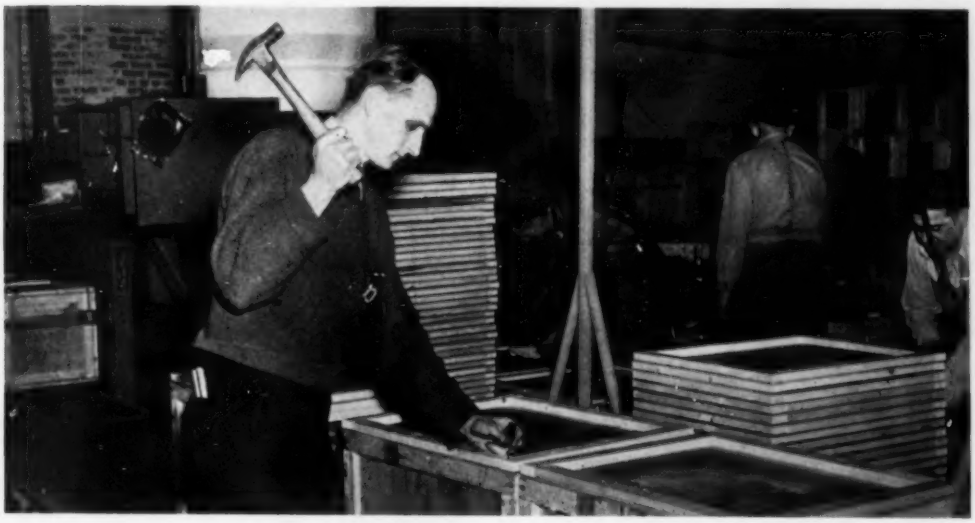
The projectors are quite heavy and not easily portable.

The initial production of a film is usually a long and costly process.

Merely to contemplate such limitations tends to discourage all but the most adventurous teachers. Especially is this so in the Bell System, where so much of our training must be done with very small groups at widely scattered points.

Yet the more far-seeing among those who have made use of films recognize that the projection equipment now available is at best an adaptation of equipment developed for the entirely different purpose of mass entertainment. Manufacturers, however, are already turning their attention to the design and development of sound motion picture equipment more adequate for teaching needs.

What is wanted, so that these limitations may be overcome, is a dependable projection unit that is small, light, sturdy and easy to operate. It should be able to project motion pictures, still pictures, sound, silent,



— driving a nail —

— writing a toll ticket —

or three dimensional. The instructor should be able to stop the machine at any point, either shutting it off or holding a picture indefinitely on the screen. He should be able to control it from his position before the class. If he wishes, he should be able to place the equipment on a desk or table and use it to instruct two or three students at a time. The pictures should be as clear in the light as in the dark. The sound should be audible to a small class, without interfering unduly with other activities in progress nearby.

Is this the expression of an unattainable ideal? The telephone teacher may be excused for hoping it is not, confronted as he is with what has been done in making realities out of the dreams of radar, television, high-speed photography, and other developments that have their roots in the same basic principles as has the training film.

Physical Characteristics of Film Techniques

THERE ARE four methods of film projection in common use.

The sound motion picture. This may be produced in either 35 m/m or 16 m/m film, but for classroom purposes 16 m/m is usually more practical. The 16 m/m sound projector weighs from 30 to 90 pounds, and costs from $150 to $500.

The silent motion picture. Sixteen m/m film without sound track is used when sound is not necessary or when the instructor wishes to discuss the film as it progresses. The 16 m/m silent projector weighs from 10 to 40 pounds, and costs from $50 to $200.

— sweeping a floor —

The sound-slide-film. This consists of still pictures produced on a strip of 35 m/m film. The sound is put on a disc record and is synchronized with the film by the operator, who pulls a cord to change the pictures. The sound-slide-film projector weighs from 35 to 50 pounds, and costs from $75 to $150. It can be effectively used with audiences up to a hundred. Smaller and cheaper projectors are available for use with smaller groups.

The silent slide-film. This may be used when sound is not necessary or when the instructor wishes to speak to his class as the pictures appear. The projector weighs from 10 to 20 pounds, and costs from $10 to $150.

Various other types of visual aids have been found effective, such as stereoscopes, opaque projectors, and glass slide projectors, but these are beyond the scope of our present discussion.

using a ladder

Costs of Film Techniques

A SOUND-SLIDE-FILM, depending on length and subject matter, may cost any amount from $500 to $10,000 to produce, and thereafter the units of film-and-record will cost from $5 to $10 each.

— enclosing a bill —

A 16 m/m sound-motion picture may cost any amount from $5,000 to $50,000 or even more, and thereafter each print will cost from $15 to $100.

These costs have been a very real deterrent to the use of films. They are much higher than the costs of the simpler visual aids for which the films may be substitutes. Such costs will seem unjustified if use of the film is restricted to a rather small area, or if it is viewed as an appendage to the training program which can be easily dispensed with.

But when these costs are viewed in relation to the whole cost of a wide-

spread training program, they appear in a different light. A $5,000 or a $20,000 motion picture, with a life of several years, may be a source of great economy if it results in doing better and faster a training job that costs $100,000 a year in the time of workers and instructors.

One of the silent slow-motion training films now being used by Bell System Accounting people was produced at a cost of less than $1,000. It was admittedly experimental. Otherwise, for an expenditure of five or ten times that amount, it might have been done in sound and color, and with dramatic effects designed to make the new employe *want* to do the job as well as *learn how* to do it. It has been estimated that the universal adoption of the method this film teaches might save the Bell System as much as $250,000 a year in operating costs. It is of course sound economy to spend as much as may be necessary to get the maximum in training effectiveness from such a film.

It is just a matter of good business to subject every contemplated training film to an analysis of this nature and, when the film is in use, to measure its worth in terms of the net cost and effectiveness of the unit of training it is intended to influence.

Experience of the Armed Services

INTEREST IN training films has been greatly stimulated by news of their use by the Army and Navy. The full significance of this development is not likely to be known until the war is over and the whole story can be told. But we do know something about that story already.

With many millions of men to be trained well and quickly, both the Army and Navy turned to visual aids of all kinds to help them. The film technicians—writers, directors, cameramen—who were not brought directly into the service were likely as not to find themselves working for independent producers under contract to make films to be shown to soldiers and sailors. A recent survey showed that 29 of these producers had made nearly 6,000 different reels or film strips for the Armed Services. Hollywood too has given its best skill to the war effort.

The soldier still learns to shoot by shooting, as in all other wars. But in this war he is introduced to the Army by indoctrination films. Morale films keep him fighting. And when at last he is mustered out, Uncle Sam's fond farewell will no doubt be spoken to him on a sound track.

Meantime film helps in the process of teaching him how to conduct himself as a soldier. If he is illiterate, the Army uses film to educate him. He learns by film how to take care of his rifle and film teaches him the dire consequences of his failure to do so. Whatever his special job, part of his training is likely to be done by film, whether it be stringing wire, firing an anti-aircraft gun, or shooting from a fighter plane against a darting Zero. The Navy dive bomber shoots camera and machine gun together so that pilots in training may see what he sees. The soldier is taught by sound pictures how to keep from being hurt, and how to take care of his own wounds and the wounds of others. If he loses a limb,

film plays its part in the long process of rehabilitation.

The Signal Corps cameraman goes with the troops, and battle scenes are brought home to teach the strategists the facts of an ever-changing warfare. As new weapons are developed, they are filmed for the better understanding of those who are to use them.

The significance of all this to the Bell System is not only the suggestion it gives of more extensive use of films in telephone training. It is also that a very sizable nucleus of this Army and Navy will be coming back to us some day. To the extent that the stories that have been reaching the home folks are true, it is likely that these telephone men and women will want to train and be trained by techniques that include the judicious use of films.

The Outlook for Films in Bell System Training

WE HAVE already seen that the returning veteran will not find the company he left behind him entirely lacking in examples of skillful use of films in training. He will find also a ready willingness to learn anything he has to teach us about it, based on his own experience. Here are some of the things he will find.

ACCOUNTING DEPARTMENT

A BELL SYSTEM executive in the field of revenue accounting had this to say in a recent memorandum:

"Since many of our routine operations involve the handling of large volumes of tickets, stubs, etc., the facility with which these records are handled assumes very important proportions. For example, we are now issuing approximately 15 million bills each month, which include among other things the charges from approximately 70 million toll calls. Those 70 million tickets must be arranged for billing, entered on toll service statements, and totals obtained. The 15 million bills must be prepared, payments credited, and many other operations performed each month as a routine procedure. Therefore, the manner or technique followed in the manual handling of this volume of relatively small pieces of paper is of prime importance.

"In view of the fact that the performance of this work is dispersed in many offices, it is our feeling that the visual presentation by moving pictures of the best known technique for performing each mass production operation will prove of real help to the Associated Companies."

Since this memorandum was written, a number of experimental films have been made by methods people in the accounting departments. They have proved worthwhile, and the experience gained by their use will no doubt lead to more and better films of this nature.

COMMERCIAL DEPARTMENT

EARLY IN 1945, a group of men from various Bell System companies gathered in New York to confer on film techniques in the training of service representatives. These men had previously made detailed studies "covering each step in the initial and continuation training of service representatives to determine opportunities for the use of films and other aids as a means of strengthening training, reducing the amount of time required, or making training more interesting."

In the meeting, these opportunities were discussed in the light of experi-

ence with films and other aids, and a complete report was prepared from which the following is a quotation:

"The need was recognized for taking full advantage of the uses of films where they would help to increase representatives' understanding of the job, develop management point of view, promote confidence in explanations to customers and good judgment in the handling of contacts, and reduce the very substantial period of time now required for initial and continuation training. However, it was agreed that there is much still to be learned before the field for use of films can be fully determined.

"It seemed evident that films would serve primarily as an occasional means of reinforcing existing training, rather than as a substitute for any of the basic training processes. To provide such reinforcement, it appeared that films would have to accomplish one or more of the following objectives:

"Better understanding and retention of the knowledge taught, with resulting better performance on the job and less need for retraining and supervisory assistance following assignment.

"Saving in training time through securing more efficient presentation of material than can be obtained by discussion, demonstration, or visits to other departments, and reducing subsequent questions by students as a result of better understanding.

A CORNER of a typical Bell System Company film library

"Improving training from the student's viewpoint by making it more interesting."

The report described seventeen subjects offering possibilities for the use of films in Commercial training and recommended that companies planning to undertake the production of films give consideration to these subjects.

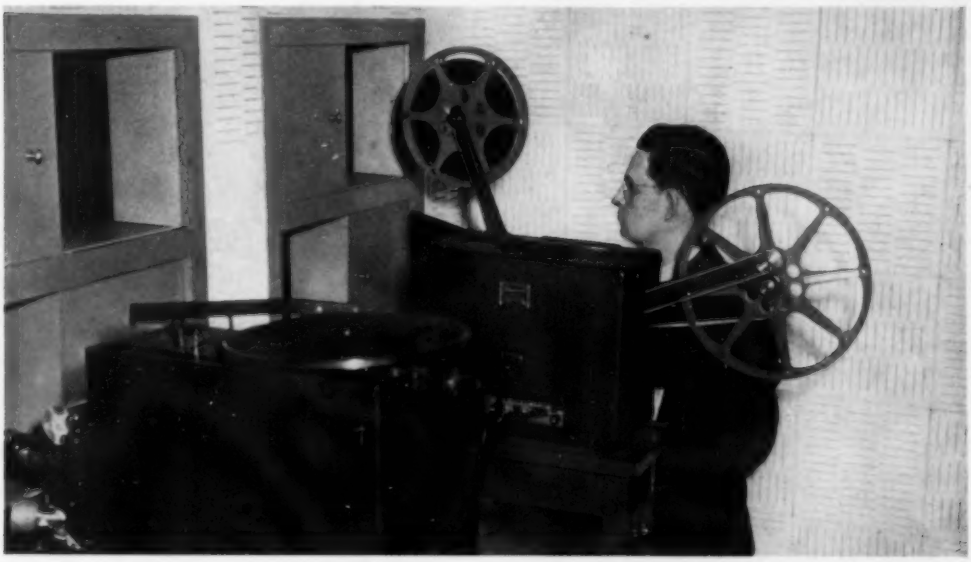
PLANT DEPARTMENT

THE PLANT DEPARTMENTS of Bell System companies have made extensive use of films in training. Films have been especially useful in teaching safe practices and in training foremen in the principles of good supervision.

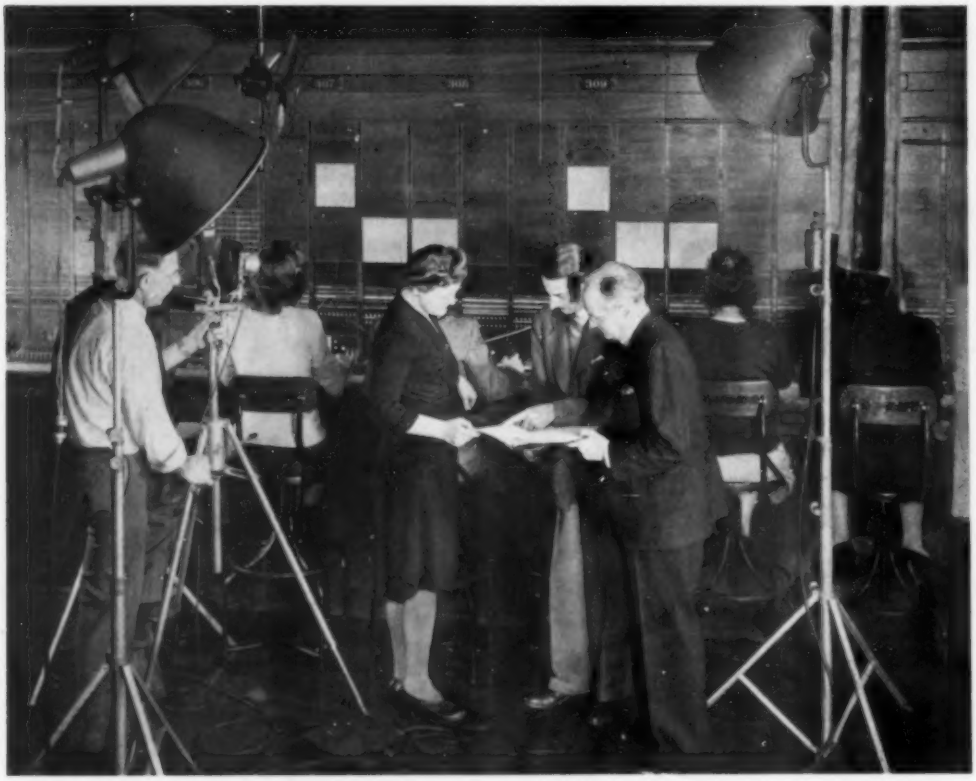
There are those who believe that it is in Plant work that films can realize their greatest value. As in other departments, "learning by doing" has been and must continue to be the fundamental of Plant training. But since the use of tools and machines is involved, calling for highly skilled craftsmen working on a great variety of tasks, there are many opportunities for the use of films all through the training process.

A preliminary study has just been completed in an attempt to appraise the extent to which films may be used to supplement "learning by doing" in Plant work. The training assignments in four selected crafts were thoroughly analyzed so as to select those in which real benefits could be obtained by the use of training films. The crafts studied were (1) cable splicing, (2) maintenance of central office frames, (3) station installation, and (4) line and cable construction. The areas in which these crafts were studied have training situations typical of those existing generally throughout the Bell System.

It appears that training films might be used to advantage in from 30 per cent to 56 per cent of the assignments in these crafts, and it is probable that some experimental films may follow as a result of the study.



A COMPANY PROJECTION BOOTH: Slide film projector on the left, 16 mm. motion picture projector on the right



A TECHNICAL CONSULTATION during the making of the slide film "Teamwork Against Trouble"

A profitable field for the use of films may be found in the introduction to Plant forces of new telephonic devices. It has always been recognized that it is important not only to design and develop such devices but to interpret and explain them in terms that can be uniformly understood by the thousands of people who must install and maintain them when they are ready to be put to public use.

In making these things publicly useful, it is necessary that the interpretive and explanatory tools be themselves understood, and that they be of the best quality. The tools include such things as charts, blueprints, written instructions, and training manuals.

It is now beginning to be recognized that film is itself one of these tools. In looking into the future, it is not difficult to envision a day when the men who design telephone equipment, and those who prepare the specifications for its installation and use, will think in terms of film as naturally as they now think in terms of these other explanatory devices.

TRAFFIC DEPARTMENT

THE TRAFFIC DEPARTMENT has less occasion to use the classroom technique than any of the other telephone

IN A HOLLYWOOD STUDIO during the filming of the motion picture "Voices of Victory"

operating departments. It has the best possible training device ready to hand in the switchboard itself. Individual instruction has thus been brought to a high level of efficiency, with most of the training being done with one, two, or three operators at the most.

Nevertheless, there is great interest in training films in this field, particularly for their value in bringing to the operator a knowledge of the work of other types of operators, and for the introduction of new methods in those special cases where large numbers of operators must be given instruction in a short period of time. Films also appear to have value in the training and development of supervisors and their further use in this field is under consideration.

The inspirational and morale-building film has been used very widely in the training of Traffic people. "Voices of Victory"—a Hollywood-made motion picture—is doing yeoman war-time service. The new picture, "The Calls That Cure," depicting telephone service in war hospitals, is now being used to illustrate the value of the operator in the war effort. And at the suggestion of Traffic training people, a similar theme has been given emphasis in

"Plan for Disaster," the film that tells the story of the 1944 hurricane.

Similar in nature are the films designed to secure coöperation in such important matters as ticketing accuracy, by showing dramatically the adverse effect that errors can have on customer attitude.

A lecture prepared by the Long Lines Plant Department, designed to improve operator coöperation in caring for the equipment she uses at the switchboard and thus conserve manpower in war-time, is now being adapted, in coöperation with Traffic people, to the sound-slide-film technique. This will expand its usefulness and relieve the skilled central office maintenance men who otherwise must be depended upon to deliver the lecture in person.

The Rôle of the Information Departments

THERE HAS BEEN a growing need for centralizing the production and procurement of training films in the Bell System. By mutual consent, the Information Department has usually been assigned this responsibility. Not only have its members had much experience with making and distributing films for public showing, but they are skilled in the graphic arts that are a part of film-making. It will be their task to keep abreast of the development of film techniques, to bring these techniques to the attention of training people in all departments, and to assist in the production of such films as training people may decide to be desirable.

MESSENGER OF SYMPATHY AND LOVE
SERVANT OF PARTED FRIENDS
CONSOLER OF THE LONELY
BOND OF THE SCATTERED FAMILY
ENLARGER OF THE COMMON LIFE
CARRIER OF NEWS AND KNOWLEDGE
INSTRUMENT OF TRADE AND INDUSTRY
PROMOTER OF MUTUAL ACQUAINTANCE
OF PEACE AND OF GOODWILL
AMONG MEN AND NATIONS

Inscription on the façade of the City Post Office in Washington, D. C.

The Telephone Companies along the Ohio Proved that They Had Learned Much about Combatting High Water When a Mighty Flood Occurred Last March

Outwitting a River on a Rampage

Ralph E. Mooney

"Me and the telephone is leaving!" So said the proprietor of a Bridgeport, Ohio, filling station as flood waters drove him from his place of business. His few words tell succinctly what happened along the Ohio this Spring when Bell companies, short-handed on account of the war, took the unusual course of broadcasting appeals to customers to rescue telephones and bell-boxes in danger of a wetting.

DWELLERS along the Ohio River watched with misgiving as heavy rains melted the snows of an extraordinary winter and brought the third-highest crest on Weather Bureau records, early last March. Everyone knew that in face of war shortages it would be disastrous if the region suffered losses like those of 1937, when the father of all floods swept the Ohio and Mississippi valleys. Telephone people, in particular, knew that any losses suffered in equipment could be replaced only with the greatest difficulty. But the flood came—and passed—and for several reasons 1945 did not turn out like 1937.

One reason was the public endeavors to prevent flood damage which had been under way since the earlier flood. This year's water was partly impounded by seven conservation dams on the Allegheny and Monongahela and a series of dams on the Muskingum. Furthermore, the Tennessee Valley system, though not complete, functioned effectively to reduce the crest on the lower reaches of the Ohio. And sea walls built since 1937 at many towns—notably Wellsville and Ironton in Ohio and Tell City and Jeffersonville in Indiana—also proved successful in keeping out the river.

Flood walls and regulation of the

water level prevented damage to much telephone equipment, of course. But still more equipment was saved by the telephone companies' own defense measures, taken during the past eight years in anticipation of the possible recurrence of severe and damaging floods.

For the Bell companies along the Ohio, Mississippi, and other rivers engaged in much soul searching after adding up the losses of 1937. They found some consolation in the sterling achievements of engineers, operators, linemen, and repairmen in keeping essential lines in service during that emergency. Gratifying, too, were the commendations received then for assistance rendered by telephone people to the Red Cross, Coast Guard, and other relief and rescue agencies. But no one could feel that these were honors to rest on. A program to safeguard against future losses was launched at once. The Bell System always has valued foresight above hindsight.

OFFHAND, the control of damage to telephone equipment from floods might seem to be a matter that Sherlock Holmes would dismiss as "elementary, my dear Watson." If a river occasionally submerges switchboards, telephones, wire and cable lines, why not move them above high water mark? At least since Noah's day, hilltops that floods never reach have been available; why not put the telephone buildings and lines up there? But it is not that simple.

River towns exist because of the rivers. They are ports. Not only do they handle freight from steamboats and barges, but the silted plains about them often are found to be valuable industrial sites, with the advantages of rail and water transportation. And if a port or manufacturing center exists, it must have telephone service, local and long distance. Therefore, only a certain amount of equipment can be taken to high locations. What remains in the lowlands must be protected by various means.

Long Lines' Protective Measures

IN THE Ohio and Mississippi valleys, the Long Lines Department of the American Telephone and Telegraph Company since 1937 has rebuilt lowland lines with more than 1700 poles tall enough to carry the wires and cables above high water. Some of these lines already have been tested two or three times and have stood firm with their wire loads safe above acres of water. Long Lines also relocated about 30 miles of lines on higher ground and rebuilt a river crossing near Murphysboro, Illinois, to provide greater clearance from flood water. At Louisville, Memphis, Alexandria, Cincinnati, and Portsmouth, long distance entrance cables were put under gas pressure so that even when they are submerged the gas will prevent water leaking in through any previously undetected small openings. At two other towns, long distance equipment was moved to first and second floor levels, and safeguards for power plants were arranged.

DURING the years since 1937, the associated Bell companies along the rivers have taken precautions that vary in degree from actually removing central offices from lowland loca-

tions to perfecting plans for the rescue of equipment which is to be left in place until the last minute.

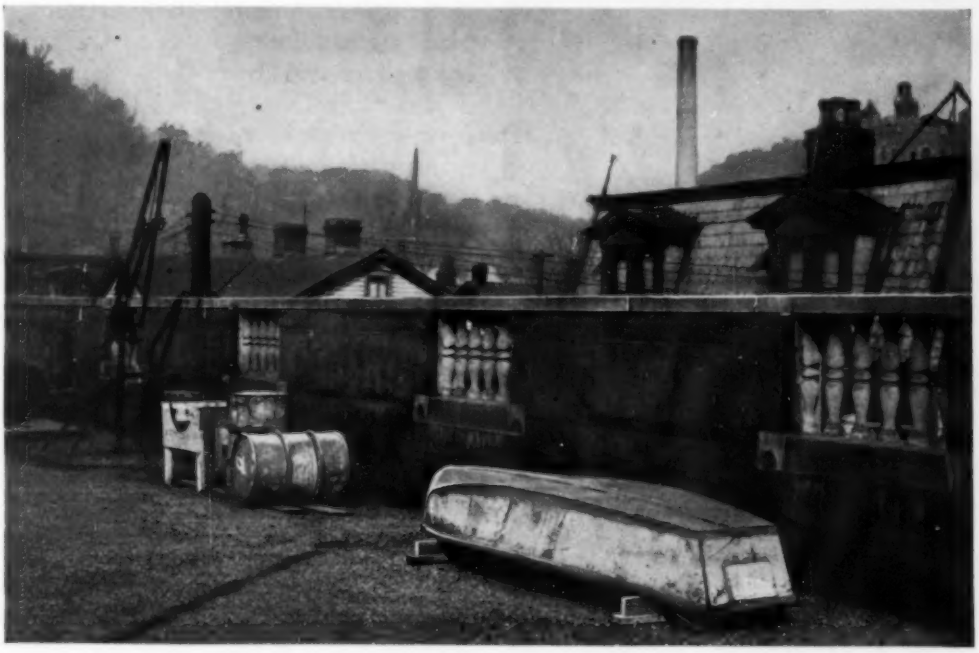
Elaborate maps of many riverside exchanges have been prepared, showing in color the areas which will be inundated at any given stage of the river. These maps, plus card systems, enable superintendents and wire chiefs to dispatch plant men systematically to rescue telephone and switchboard equipment as the water rises. The stages of the river might be said to be announced by *Green, Blue,* and *Red* warnings somewhat like the recently abandoned Civilian Defense air-raid alarms.

Also, where equipment must be used in lowland locations the following practices have become standard:

Cross-connecting and house cable terminals are placed above flood levels on poles and buildings wherever possible. If terminals must be installed where they are likely to be submerged, a sealed chamber is used and the cable run through a cross-connecting box above flood level, so that only the pairs in the sealed terminal will be affected.

Underground cables which are not under continuous gas pressure are equipped with valves so that gas can be fed in if it appears probable that they will be submerged.

When a PBX or key equipment is to be installed, arrangements for protecting the equipment during a flood are discussed with the customer and made certain. Some in-



BOAT, drums of fuel, and hoisting apparatus on the roof of a telephone building indicate how thoroughly preparations were made for an emergency in the flood zone last March

genious schemes have been worked out—such as a block-and-tackle hoist to lift a PBX switchboard through openings in the floors to levels on which it can continue to function during high water, and to lower it again to the location desired by the customer under normal conditions.

Baseboard wiring for buzzer and key systems is not nailed in place, but is fastened with clamps so that it can be swiftly removed.

EMERGENCY STOCKS of many kinds were stored in telephone central offices up and down the river

At Pittsburgh

PITTSBURGH was the first to act on warnings of this year's flood, but the river rose only to a stage of 33.5 feet—not high enough to do much damage. No telephones or bellboxes were lost.

At Pittsburgh and all other river towns, however, it was necessary to marshal defenses on receipt of the warning. That meant checking and building up emergency stocks of repair material, making ready with boats and rubber boots for telephone men, and arranging for stoves, blankets and cots at central offices which might be isolated. Fuel supplies were gathered for emergency power generators and materials were assembled for sandbag barricades to protect cellars and lower-floor openings. The Traffic Departments had to review their plans to make certain of transportation of operators to the offices wherever bus or street railway service might be suspended.

In West Virginia

BELOW Pittsburgh, the Chesapeake and Potomac Telephone Company of West Virginia has 20 central offices serving 66,000 telephones along the Ohio. When a flood occurs, a majority of the people in this area move their furniture above the expected flood stage and remain in their homes. The telephone company in normal times looks after the telephone equipment; and the whole, as may be gathered, is somewhat a routine proceeding.

This year it was necessary to remove or relocate 11 private branch exchanges, 9 key equipments, 23 booths, and 1,538 telephone. About a third of the telephones were saved by customers acting at the request of the company as a war measure. In the over-all job, only 23 telephones and 8 bellboxes were damaged. This compares with a loss of 1,768 telephones and 146 bellboxes in 1937.

In Ohio

NO EQUIPMENT was lost during the 1945 flood in the territory of the Ohio Bell Telephone Company. In the Zanesville district, on the Muskingum river in the upper Ohio valley, subscribers removed 446 telephones at the company's request. Many of these customers said they were pleased to know that service could be maintained until they were forced to vacate.

At Steubenville, Ohio, flood stage is 35 feet. The crest this year was 44.3. The telephone company's pole yard was flooded, but all the poles had been securely lashed, so the only damage was to the driveways, which required 65 tons of slag to make them serviceable again. All told, 176 telephones were removed, most of them in the Follansbee and Weirton steel plants adjacent to the river. Interruption of war work at these plants was a serious matter, and the telephone company made every effort to maintain service till the last minute, and to restore it as soon as possible.

At Bridgeport, 213 telephones were removed. When water blocked the entrance to the telephone office, a fire escape was rigged to a neighboring building whose entrance was dry, and all employees had to enter and leave by that route. Under a bridge adjacent to the office, a jam of driftwood threatened to make trouble, but two experienced rivermen in a rowboat were able to clear it with a boat hook in a few hours.

Marietta, Ohio, greeted the oncoming flood as if it were a county fair. Trucks backed in hub to hub to move out stock from the Front Street stores. No one hurried—they had done this before. But move out they did, and the river took over. Meanwhile, the telephone people began on the river front and worked back up the hill, removing telephones and equipment. All told, the equipment for 826 stations was saved. When PBX boards were taken out or shifted, the cables were cut off and capped. The business office in Marietta was moved to the second floor of a bank building, and the records taken to a central office uptown.

PRECAUTIONS of another sort: protector installations high on the outside walls of residences, beyond the reach of flood waters

Some lashings gave way in the pole yards, but the loose poles floated into a backwater, where three telephone men had the seafaring job of following them in boats in order to drive a staple into each pole and then anchor it or tie it up.

Soon the river began to recede. Marietta fire hoses flushed away the silt that covered the streets and floors. Truckmen hauled off rubbish and brush piles. And back came the telephones to the water front.

At Ripley, Ohio, further down the river, the central office was moved to high ground shortly after the 1937 flood. It was never in danger this year, although high water covered the business district.

A PUBLIC TELEPHONE is brought to dry land and a longer life of service

At Cincinnati

THE Cincinnati and Suburban Bell Telephone Company reports that while each flood in that city's history added some "know how" to previously accumulated experience, it remained for the 79.9 foot flood of 1937 to become the most effective teacher.

Lessons learned then resulted in rearrangements and improved procedures which were effective against the 69.2 foot flood this year. The company's office at New Richmond, Ohio, which was put out of service during the 1937 flood, has been replaced with a community dial unit located on a hillside well above the 80 foot stage. Old "South" office at Covington, Kentucky, which required sandbag dikes and constant pumping to keep water out of the basement power room in 1937, has been transferred to the Hemlock building, on a high level. Although the power com-

panies serving the area have improved their plant against flood too, auxiliary power has been installed in all Cincinnati telephone buildings as a further precautionary measure. Wherever possible, customer equipment has been removed to safe locations.

When the Ohio river approaches 60 feet (flood stage, 52 feet) and threatens to go higher, "flood bureaus" are established in the three plant district test centers at Cincinnati, and requests from customers to have telephones removed or moved to other locations are directed by the Traffic Department to these bureaus. When the volume of requests makes it necessary, the bureaus are manned on a 24-hour basis by representatives of the Commercial, Plant and Traffic Departments.

All told, 7,326 telephones were involved in the 1945 flood at Cincinnati. Of these, 945 were moved temporarily to new locations, while 6,381 were taken out pending reestablishment of service after the flood. Of 115 installations involving PBX, TWX, and key cabinet equipment, there was only one recorded loss, and in total about 268 telephones were damaged.

TELEPHONE POLES which broke loose from an inundated pole yard and floated away are towed to a safe harbor

In Kentucky

IN THE Owensboro district of Kentucky, served by the Southern Bell Telephone and Telegraph Company, anti-flood engineering was begun immediately after the waters receded in 1937. All toll lines were raised to levels that would eliminate any possibility of their being submerged or damaged by floating debris. Several magneto offices were converted to community dial and placed above

flood level. Eddyville and Maceo are two central offices that were damaged in 1937 which now stand on high ground.

The citizens of Paducah suffered so severely during the flood in 1937 that this year's warnings were received with considerable alarm. This put a heavy burden on the Southern Bell Company's equipment and personnel at a time when service at the highest possible efficiency was required to expedite the work of the emergency committees appointed by city authorities. Furthermore, telephone people themselves were worried for their families and household possessions. Transportation had become a serious problem as one by one the highways out of Paducah became blocked by high water.

A FREQUENT SIGHT along the Ohio River last Spring: temporary removal of equipment ahead of rising waters

A meeting of telephone employees was held at which all available information on the flood was circulated. To those concerned about families and furniture, the company offered its assistance. Since the trucking companies of Paducah were overloaded, arrangements were made for vans from Madisonville to come into Paducah for the purpose of rescuing employees' furniture should necessity arise. It was also arranged to rent Club Lakeview, outside the flood district, to be used as a dormitory for telephone people who might be routed from their homes. A milk company at Mayfield was asked to make ready to supply ten-gallon cans in case it became necessary to haul drinking water. Plans were even made to establish an emergency common-battery office outside the flooded district in the event of a repetition of 1937.

After 1937, however, Paducah had seen to the building of a concrete wall to protect against a 63-foot level. The war had prevented installation of the flood gates in this wall, and of related pumping equipment. The United States Engineer Corps arranged to sandbag the open gates and to borrow pumps from the Tennessee Valley Authority. The pumps cleared low-lying streets of water from blocked sewers and heavy rains. And by regulation of the flow of the Tennessee river at Kentucky Dam, the crest at Paducah was held to 50.5 feet. The sun came out and the crisis passed with muddy water

lapping just four and one-half feet below the crown of the sandbag dams in the flood gates.

In Indiana

ALONG THE Indiana side of the river, in the territory of the Indiana Bell Telephone Company, damage to telephone plant was slight, for here again "the levees held." Here, also, customers helped in removal of telephones and bellboxes, so that very little equipment was damaged.

A broken sewer tile let backwater flow into the basement of the old local office building at New Albany, but by constant use of pumps the water was held to a level of four inches, not enough to affect the furnace, cables, or other equipment.

At Evansville, the only other major Indiana exchange threatened by the flood, a crest of 48.3 feet was reached on March 11, as compared with 53.8 feet on January 31, 1937. Every effort was made to remove telephones from homes as rapidly as they were evacuated. To make more certain of the recovery of instruments so vital in wartime, a special line was installed so that the Red Cross office could notify the telephone company whenever it was necessary to evacuate a dwelling. Part of the recovery work was done by combinationmen and linemen in rowboats. They brought in 75 telephones. In all, 250 telephones were moved from flooded areas in Evansville.

In Illinois

THREE Illinois Bell exchanges along the Ohio—Cairo, Mounds, and Mound City—were in no danger from the March flood this year. Protected by a sea wall, they are threatened only when the Ohio and Mississippi are both at flood stage.

ON A temporary platform raised four feet above the floor, two loyal women maintained service through this switchboard for two weeks while isolated within the office

Emergencies Are Overcome

EACH EMERGENCY—each upheaval from normal life—means extra work at top speed for the men who install and maintain telephone equipment, and for telephone operators. Sometimes it means work under extremely trying conditions. This year, for example, West Point, Kentucky, between Louisville and Fort Knox, in

Southern Bell territory, was ordered evacuated by the Army Command at Fort Knox, on the afternoon of March 6. The homes of all West Point operators—five in number—were flooded.

But although the water was still rising and the telephone office was completely surrounded, the night operator got a rowboat and returned to the office of her own accord on March 7. She restored toll service, and local service on the 15 lines still working. Two days later the chief operator was able to return to the office in an Army amphibious vehicle, and a little later two other operators joined them.

Fort Knox itself was teeming with activity all this while. With the military personnel confined to the post, and with a large population of evacuees in addition, the switchboard and the attended pay stations were swamped with calls.

At Louisville, many operators had to move to temporary quarters because of flooded basements at home or because water in the streets made their homes inaccessible. They remained on duty, however, and some took advantage of the living arrangements provided at the telephone offices by the Southern Bell Telephone Company. When the high schools of Louisville were dismissed at 11 a. m., March 6, nearly all of the 90 high-school girls who were working part time for the telephone company reported for duty. Many former operators also offered their services.

At both the Louisville and Paducah long distance and local boards, calls came too rapidly to be counted during the crest periods. At Jeffer-

Many thousands of telephones were saved from damage by being removed from structures in the high-water area and stored in safety until the flood receded

sonville, Indiana, at times 90 per cent of the switchboard lamps appeared to be lighted. At New Albany, long distance calls were twice those of a normal wartime day.

At Grandview, some 32 miles up the river from Evansville, Indiana, water rose to within inches of the floor of the telephone exchange. The wire chief and combinationman, with the advice and assistance of the Evansville district plant superintendent, constructed a seven-by-nine-foot platform on saw horses 50 inches above the floor. They put the switchboard on the platform and also contrived to place a cot beside it.

From this lofty perch, the agent and her operator handled Grandview's telephone calls for two weeks. They could not set foot outside the office, and were dependent on the men for food, coal, and other necessities brought by boat from Rockport, five miles away.

While these are possibly the most newsworthy incidents reported in connection with this year's flood-time telephone service, the fact must not be overlooked that tremendous traffic and urgent situations had to be dealt with from Pittsburgh to Cairo.

OPPORTUNITY was taken to recondition key cabinets and PBX switchboards while they were out of service

THIS YEAR'S highly successful countering of a great Ohio flood had importance beyond the intrinsic value of equipment saved and loss prevented, for in wartime such home

front victories aid the smooth supply of armies at the front. As in every telephone achievement, two factors were involved. One was the Bell System's willingness to learn lessons and plan ever more thoroughly to circumvent emergencies. The other was the unfailing response to public need that is characteristic of telephone people on the job. The coming of the flood found the supervisory groups better prepared than they ever had been before. And it found the telephone men and women of the Ohio Valley exchanges ready as always to make any necessary personal sacrifice to get the message through.

Singing Wires

WHEN WINTER is about ready to abdicate to spring, and the pussy willows lift their branches, comes the time when the telephone wires along the winding back-country roads sing their arias of a new season. Singing wires are a part of the music in the air when spring is ready to ascend her throne.

There is undoubtedly a learned scientific reason why telephone wires put on their orchestral performance. This is a scientific age and we cannot expect even a free symphony to occur without good reason. Perhaps the best performances of the year are given in late March. On a mellow day when the south wind is blowing, when the sky is wearing its cape of deepest blue, with a few masses of white cumulus clouds for ruffles, the wires seem to enjoy their steady song.

The song of the wires is steady but it is not monotonous. There are overtones of lyrical runs, long sustained notes in alto and contralto key, deeper intermittent overtones of resonant bass. Occasionally one gets a faint hint of a clean, haunting pure high tenor. There are times when the tempo mounts in crescendo fortissimo; one almost expects the crash of the percussion instruments and the stirring lifting power of the brasses. Then, again, the wires sing softly of day's loveliness, humming a theme of unexplored possibilities, sustaining the music to accompany the rollicking optimism of robins.

There are men and women in city offices who will look out their windows these hope-stirring days and think of country roads far away where the telephone wires run from weathered pole to pole, above the lichened stone walls or split rail fences. Years ago they listened to the singing wires. Boys and girls coming home from schoolhouses with lunch boxes in hand still stop to listen. In the song of wires in spring, youth has heard the call to paths of adventure.

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